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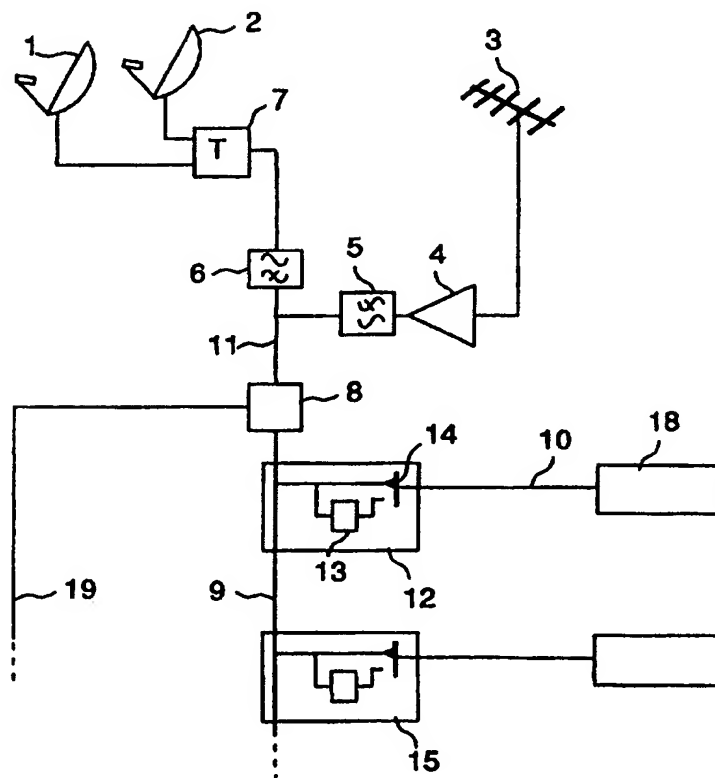


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/IB97/00664 <b>(22) International Filing Date:</b> 9 June 1997 (09.06.97)  <b>(30) Priority Data:</b> 96/07634                      19 June 1996 (19.06.96)                      FR  <b>(71) Applicant (for all designated States except US):</b> PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> CHANTEAU, Pierre [FR/FR]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).  <b>(74) Agent:</b> CARON, Jean; Internationaal Octrooibureau B.V., P.O. Box 220, NL-5600 AE Eindhoven (NL).		<b>(81) Designated States:</b> JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** VIDEO COMMUNICATION NETWORK**(57) Abstract**

A converter (7) converts a set of satellite channels in a frequency band completely situated above the frequency band that is likely to be used by a user apparatus (18) and is provided on a distribution cable (9). To use this set of converted channels in a user apparatus (18), a signal tapping element includes a transposer (13) which lowers the frequency of the channels of this second set. Applications: signal distribution, notably television signal distribution.



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Video communication network.

The present invention relates to a method of increasing the capacity, expressed in a number of channels, of a video communication signal distribution network in which a set of video communication channels received by satellite, called satellite channels, is converted into a set of channels called converted channels intended to be delivered by a distribution channel and used by at least one user apparatus capable of using channels in a predetermined frequency band.

The invention also relates to a video communication signal distribution network, comprising a network head-end with at least one satellite television broadcast converter, the converter delivering a set of converted channels by a cable, which channels are converted to a predetermined band likely to be used by a user apparatus, and at least one signal tapping element for supplying signals from the cable to at least one user apparatus.

The invention likewise relates to a video communication network head-end as defined above.

The invention finally relates to a signal tapping element as defined above.

A video communication signal distribution network is known from Patent EP 0 583 843. According to this document, a plurality of cables are used, each transporting different converted channels, all situated in the band likely to be used by a user apparatus, and a switch at the level of the signal tapping element permitting to select the desired cable.

It is an object of the invention to simplify the realization of the network by using only a single cable which carries more channels than permitted by the band which is likely to be used by a user apparatus.

For this purpose, at least a second set of satellite channels is converted to a frequency band completely situated above said predetermined frequency band and is delivered by the same distribution cable and, for the use of the second set of converted channels in at least one user apparatus, the channels of this second set are translated while their frequency is lowered.

Advantageously, for the second set of converted channels, a frequency band is used having the same bandwidth as for the first set, and a gap is left open between the frequency band of the second set of converted channels and the frequency band of the

first set of converted channels.

Thus, a possible frequency translation and filtering are simplified.

A video communication network according to the invention comprises means for creating a second set of television channels occupying a frequency band situated  
5 above said predetermined band and for delivering them by a cable, and the signal tapping element comprises translation means called user translation means for translating the second set of television channels by lowering its frequency so as to restore the second set in said predetermined band, and means for switching or not the user translation means into service upon request.

10 Preferably, a gap of at least 100 MHz is provided between the frequency band of the first set of converted channels and the frequency band of the second set of converted channels.

A video communication network head-end according to the invention comprises means for creating a second set of converted channels which occupy a frequency  
15 band situated above said predetermined band, and for delivering them by the cable.

A signal tapping element according to the invention comprises translation means for translating, while lowering their frequency, a part of the television channels, and means for switching or not these translation means into service upon request.

20 Preferably, the value of the frequency translation provided by the translation means is at least equal to 1300 MHz.

In an advantageous embodiment, the means for switching or not the translation means into circuit are actuated either by the presence of a 14 to 18 volts control voltage, or by the presence or absence of a 22 kHz AC voltage.

25 These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawings:

30 Fig. 1 represents in a diagram a video communication network according to the invention;

Fig. 2 represents a variant of an embodiment of the network head-end;

Fig. 3 represents in more detail certain parts of the network of Fig. 1;

Fig. 4 is a frequency diagram of the channels found in the network according to the invention, in a first embodiment option, and

Fig. 5 is a frequency diagram of the channels found in the network according to the invention, in a second embodiment option.

The network shown in Fig. 1 comprises a network head-end, at least one distribution cable, and at least one signal tapping element. The network head-end, shown in its simplest form here, comprises two dish antennas 1 and 2 for satellite television reception, and a module 7 for frequency translation for the dish antenna 2. The dish antennas 1 and 2 can receive each forty channels having a bandwidth of 30 MHz and have each an integrated conversion block called "LNB", producing the channels in the 950-2150 MHz frequency band. The module 7 translates the channels coming from the dish antenna 2 to form forty channels having a bandwidth of 30 MHz each, in the 2250-3450 MHz frequency band. There is a gap of 100 MHz between the top of the 950-2150 MHz band and the bottom of the 2250-3450 MHz band, to facilitate, as required, the separation between these two bands by filtering. All the channels are together applied to a cable 11, through a high-pass filter 6, which passes the frequencies higher than or equal to 950 MHz. An antenna 3 for the terrestrial channels produces channels in a band running from 47 to 860 MHz. These channels are amplified in an amplifier 4 and applied to the cable 11 via a low-pass filter 5 which passes the frequencies lower than or equal to 860 MHz. By way of example, a distributor 8 distributes the signals over the two cables 9 and 19 going downstream.

Signal tapping elements or splitters 12 (or 15, identical to 12) are connected to the cable 9, each feeding a user apparatus, for example, a receiver decoder 18 connected to the splitter 12 by a user cable 10 and capable of utilizing channels in a predetermined frequency band which is habitually the 950-2150 MHz frequency band. Each splitter contains a frequency converter module 13 which lowers the frequencies of the signals received in its input by 1300 MHz. Thus the band running from 2250 to 3450 MHz is converted to a band running from 950 to 2150 MHz, which corresponds to the band that can be used by a receiver/decoder. A switch 14 makes it possible to connect the user apparatus either directly to the cable, or to the output of the converter module 14. Thus, depending on the position of the switch, the receiver decoder will be capable of processing either directly the channels of the 950-2150 MHz band of the cable, or the channels of the 2250-3450 MHz band of the cable, converted to the 950-2150 MHz band by the converter 13.

The network head-end represented in Fig. 2 forms a variant which may be used in lieu of the elements 1, 2, 7 of Fig. 1. It comprises four dish antennas 22, 23, 26, 27 comprising each a LNB which produces channels having a bandwidth of 30 MHz each in a 950-2150 MHz band. The module 24 derives forty satellite channels having each a bandwidth

of 30 MHz chosen from all the channels received by the two dish antennas 22 and 23, and translates each of them into a separate channel of the 2250-3450 MHz band. The module 29 selects forty channels having each a bandwidth of 30 MHz, chosen from all the channels received by the two dish antennas 26 and 27, each in a separate channel of the 950-2150  
5 MHz band, adds thereto the channels coming from module 24 and applies all of them to the cable 11, while all the 950-3450 MHz channels are finally amplified in an amplifier 25. As a variant, there could be a single dish antenna instead of the two dish antennas 22, 23 and/or instead of the two dish antennas 26, 27, when channels are used coming from two polarizations H and V of the same dish antenna.

10                Instead of starting from channels in the 950-2150 MHz band and subsequently translating them, it is also possible to convert each of the satellite channels directly to a converted frequency of the 2250-3450 MHz band, in a LNB provided for this purpose. This can be contemplated economically if the quantities are sufficient to permit the financial settlement of the development of a specific LNB.

15                Fig. 3A represents a transposer, for example, the one referenced 7 in the basic arrangement of Fig. 1. It receives on cable 32 the channels coming from the dish antenna 2 and on the cable 33 the channels coming from the dish antenna 1. A modulator or mixer 34 of any known type (active-circuit, Gilbert, transformer, etc.) is fed by an oscillator 35. The output signal of the mixer 34 is applied to the cable 11 via a high-pass filter 37  
20 which passes the frequencies higher than or equal to 2250 MHz. The result of mixer 34 is that the channels arriving at the input 32 in the 2250-3450 MHz band are converted to the 950-2150 MHz band. The signal on the input 33 passes without a frequency change on cable 11, via a low-pass filter 36 which passes the frequencies lower than or equal 2150 MHz.

                 Fig. 3B represents an embodiment of the splitter referenced 12 in Fig. 1.

25                A resistor 43 makes it possible to tap the whole signal coming from cable 9 in known manner while the impedance is adapted, and the tapped signal is taken to a modulator or mixer 42 of any known type (active-circuit, Gilbert, transformer, etc.). This mixer is fed by an oscillator 41. The result of the mixer is that the channels of the 2250-3450 MHz band present on cable 9 are converted to the 950-2150 MHz band. This mixer is of a model that  
30 produces shifted channels on the output, but whose incoming channels are suppressed or at least attenuated considerably. The signal on the output of the mixer 42 is amplified by an amplifier 39 and leaves by cable 10. By this cable, the user apparatus of Fig. 1 sends an information signal to indicate whether they are the channels using the upper side band of the 950-2150 MHz band of the cable which are desired, or whether they are the channels

converted to the 2250-3450 MHz band. This information signal, produced by the user apparatus may, for example, consist of the fact that a DC control voltage has a value of 14 or 18 volts, or also of the fact that a 22 kHz AC voltage is present or not, or may also be an information signal of the type "DiSEqC" in which a 22 kHz AC voltage is switched to form words. The module 40, connected to cable 10, detects the information concerned and controls the oscillator 41 to operate or stop. If this oscillator is stopped, the channels of the 950-2150 MHz band pass directly, and if the oscillator is in operation, it is the channels of the 2250-3450 MHz band that are received on cable 10. This represents an alternative with respect to a switching operation which purely and simply short-circuits the converter 13 of Fig. 1.

It is the object of the Figs. 4 and 5 to illustrate the choice of the frequency of the oscillators 35 or 41. In the two Figures, the first line represents channels in the 950-2150 MHz band, such as produced by a LNB, those indicated L positioned low in the band, those indicated H positioned high in the band.

In Fig. 4, a 4400 MHz oscillator has been chosen whose frequency is indicated by a vertical broken line. The mixer 34 of Fig. 3A produces the channels indicated on the second line. The channels L and H became, respectively:

- the channels L\* and H\*, ranging from 2250 to 3450 MHz, by subtracting the value of the frequency from the value of 4400 MHz. The order of the channels is inverted: H\* is to the left of L\*.
- the channels L\*\* and H\*\*, ranging from 5350 to 6550 MHz, by adding the value of their frequency to the value of 4400 MHz. These channels are not annoying, and, furthermore, they have every chance of being suppressed in a natural way, because the passband of the amplifiers is limited.

The signals finally applied to cable 9 are indicated on the third line, the addition of the various channels producing a "terrestrial" band, denoted T (47-860 MHz), a L-H band (950-2150 MHz) coming, for example, from the dish antenna 1 of Fig. 1, and a band H\*-L\* (2250-3450 MHz) obtained by frequency translation.

The oscillator 41 of the mixer 42 is also working at 4400 MHz, and when the signals pass through this mixer, channels indicated on the fourth line are produced: the band T gives the band T<sup>^</sup>, the band H\*-L\* gives the band L\*<sup>^</sup>-H\*<sup>^</sup>, the band L-H gives the band H<sup>^</sup>-L<sup>^</sup>, with, furthermore, the corresponding bands indicated by <sup>^^</sup> above the frequency of the oscillator. The band L-H of the third line is stopped by the mixer. Only the band L\*<sup>^</sup>-H\*<sup>^</sup>, whose channels are in the right order, is likely to be used by a user

apparatus.

In Fig. 5, a 1300 MHz oscillator has been chosen, that means, in the band L-H. The mixer 34 of Fig. 3A produces the channels indicated on the second line. The channels below 1300 MHz are called L, and the channels above 1300 MHz are called H. The channels L and H are the result of the subtraction of the value of 1300 MHz from the value of their frequency, the channels L\* and H\* ranging from 0 to 850 MHz, but with an overlap (the channels H\* are indicated upside down for clarity). By adding the value of their frequency to the value of 1300 MHz, the channels L\*\* and H\*\* are obtained, ranging from 2250 to 3450 MHz. It will be evident that if the signals of the second line are applied to cable 9, there will be a collision between the signals L\*, H\* and the terrestrial signals, unless they are filtered beforehand to eliminate the band L\*-H\*. The frequency diagram of Fig. 4 is thus to be preferred.

It will be evident that numerous variants may be provided in the description given above, for example, the distributor 8 of Fig. 1 could also be omitted (a single cable), or, on the contrary, serve more than two cables, for example, four; the splitter casings 12, 15 could contain each, for example, two or four assemblies such as 13 + 14 to serve two or four users; the converted band could also be placed at even higher frequencies (higher than 2250-3450 MHz) to obtain a gap larger than 100 MHz between the bands; in the case of digital television channels, the 40 channels of 30 MHz could be 30 channels of 40 MHz bandwidth.

CLAIMS:

1. A method of increasing the capacity, expressed in a number of channels, of a video communication signal distribution network in which a set of video communication channels received by satellite, called satellite channels, is converted into a set of channels called converted channels intended to be delivered by a distribution channel and used by at least one user apparatus capable of using channels in a predetermined frequency band, characterized in that at least a second set of satellite channels is converted to a frequency band completely situated above said predetermined frequency band and is delivered by the same distribution cable and, for the use of the second set of converted channels in at least one user apparatus, the channels of this second set are translated while their frequency is lowered.
2. A method as claimed in Claim 1, characterized in that for the second set of converted channels, a frequency band is used having the same bandwidth as for the first set.
3. A method as claimed in Claim 1, characterized in that a gap is left open between the frequency band of the second set of converted channels and the frequency band of the first set of converted channels.
4. A video communication signal distribution network, comprising a distribution cable, at least one signal tapping element for supplying, from the cable, signals to at least one user apparatus capable of using channels in a predetermined frequency band, at least one satellite television broadcast converter delivering by the cable a set of television channels in said predetermined band, characterized in that it further includes means for creating a second set of television channels occupying a frequency band situated above said predetermined band and delivering them by the cable, and in that the signal tapping element comprises translation means called user translation means for translating the second set of television channels by lowering its frequency so as to restore the second set in said predetermined band, and means for switching or not the user translation means into service upon request.
5. A video communication network as claimed in Claim 4, characterized in that a gap of at least 100 MHz is provided between the frequency band of the first set of

converted channels and the frequency band of the second set of converted channels.

6. A video communication network head-end comprising at least one satellite television broadcast converter delivering by a cable a set of converted channels in a predetermined band likely to be used by a user apparatus, characterized in that it further  
5 includes means for creating a second set of television channels which occupies a frequency band situated above said predetermined band, and for delivering them by the cable.

7. A video communication network head-end as claimed in Claim 6, characterized in that the difference between the frequency band of the first set of converted channels and the frequency band of the second set of converted channels is at least 100 MHz.

10 8. A signal tapping element for supplying signals to at least one user apparatus from a cable of a video communication apparatus transporting television channels, characterized in that it comprises translation means for translating a part of the television channels by lowering their frequency, and means for switching or not these translation means  
15 into service or not upon request.

9. A signal tapping element as claimed in Claim 8, characterized in that the frequency translation value brought about by the translation means is at least equal to 1300 MHz.

10. A signal tapping element as claimed in Claim 9, characterized in that the  
20 means for switching or not the translation means into service are activated either by the presence of a 14 or 18 volts control voltage, or by the presence or not of a 22 kHz AC voltage.

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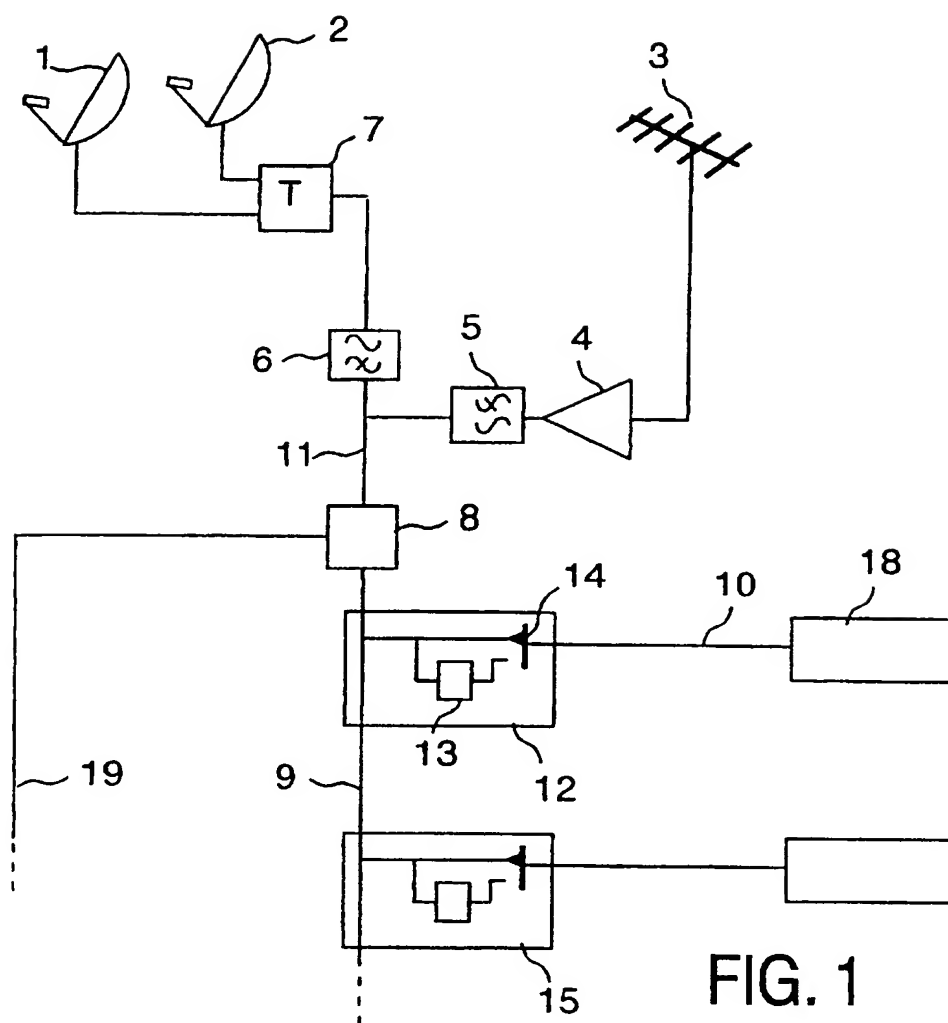


FIG. 1

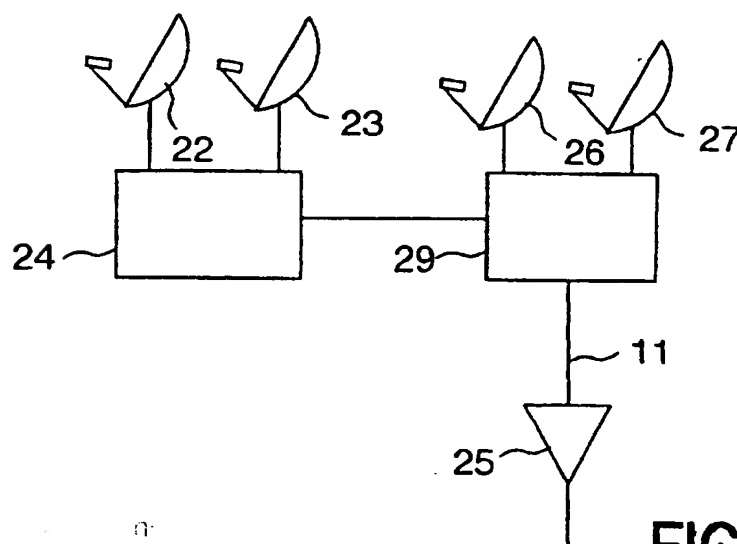


FIG. 2

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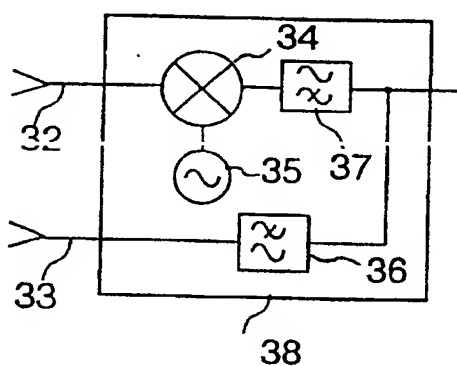


FIG. 3A

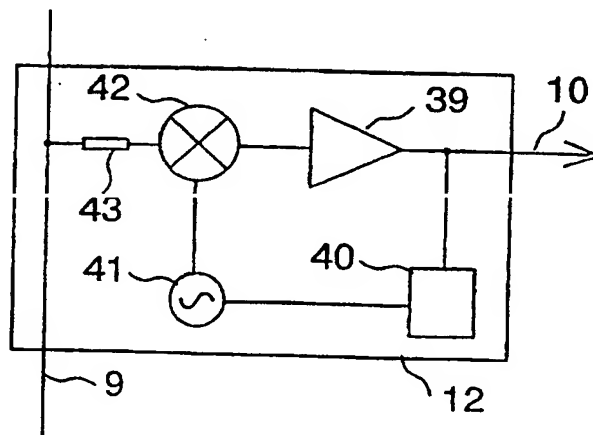


FIG. 3B

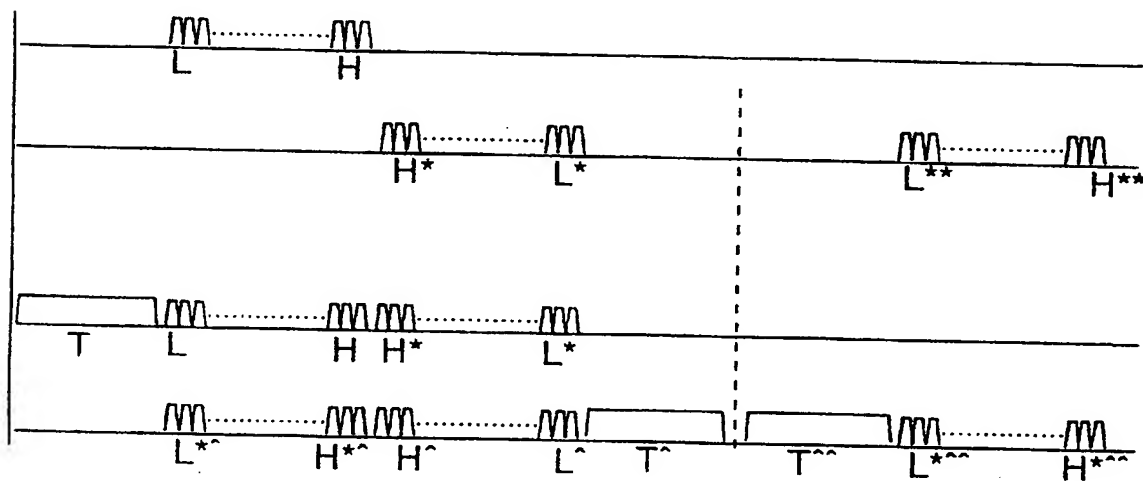


FIG. 4

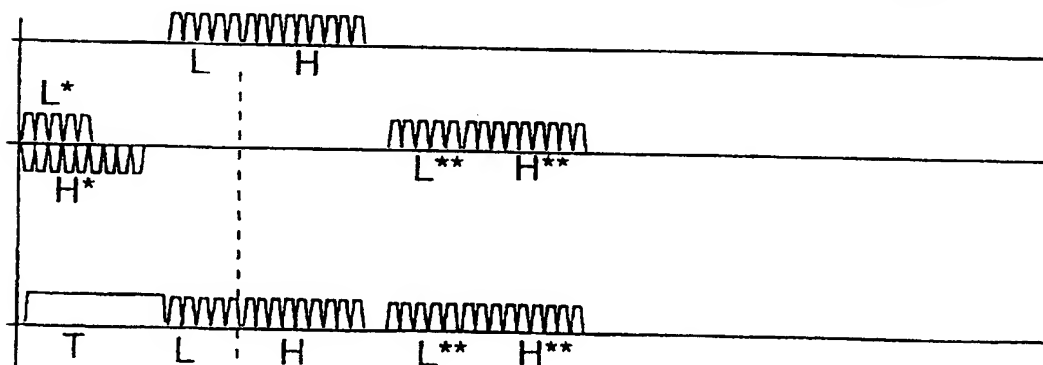


FIG. 5

# INTERNATIONAL SEARCH REPORT

International Application No  
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 6 H04N7/10		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 6 H04N		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IEEE COMMUNICATIONS MAGAZINE, vol. 30, no. 8, August 1992, NEW YORK, pages 58-64, XP000310949 J. TERRY: "Alternative technologies and delivery systems for broadband ISDN access" see figures 4,5 ---	1-10
X	EP 0 583 830 A (PHILIPS ELECTRONIQUE GRAND PUB ; PHILIPS ELECTRONICS NV (NL)) 23 February 1994 see column 4, line 4 - column 6, line 5 ---	8-10
A	FR 2 662 895 A (TELEDIFFUSION FSE) 6 December 1991 see abstract; figure 1 --- -/--	1-10
<div style="display: flex; justify-content: space-between;"> <span><input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.</span> <span><input checked="" type="checkbox"/> Patent family members are listed in annex.</span> </div>		
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Date of the actual completion of the international search  <div style="text-align: center; font-weight: bold;">29 August 1997</div>		Date of mailing of the international search report  <div style="text-align: center; font-weight: bold;">08.09.97</div>
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RADIO FERNSEHEN ELEKTRONIK, vol. 41, no. 4, 1 January 1992, pages 279-281, XP000284798 JUNGK K: "EINKABELLOESUNG 2000" see the whole document ---	1-10
A	FR 2 680 935 A (TELEDIFFUSION DE FRANCE) 5 March 1993 see page 1, line 1 - page 2, line 7 -----	1-10

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 97/00664

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0583830 A	23-02-94	CN 1085035 A FI 933607 A US 5386226 A	06-04-94 20-02-94 31-01-95
FR 2662895 A	06-12-91	NONE	
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